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THE YELLOW CURRANT FLY OR GOOSEBERRY FRUIT FLY. (*EPOCHRA CANADENSIS* LOEW.)

By John Howard Paine,
Stanford University, California.

HISTORY AND DISTRIBUTION.

The Yellow Currant Fly, or The Currant Fly, as it was called until the appearance in Washington of a similar insect (*Rhagoletis ribicola* Doane)[1] affecting the same hosts made the use of a more specific name necessary, was first described by Loew in 1873 from a single faded specimen contributed by Osten Sacken. The type locality is either Canada or Maine, Osten Sacken giving Norway, Maine, as the locality for his material and Loew giving Canada as a locality upon the authority of Mr. Provancher. One cannot say how long the species may have been known before its description, and Osten Sacken says that it "seems to be common in those regions." If he knew of its currant-infesting habits, no mention was made of them.

In 1883 the Currant Fly was again brought to notice when its currant-infesting habits were recorded for the first time by Saunders, though his knowledge on the subject was apparently slight.

The first detailed account of this species was given by Prof. C. P. Gillette who found it very abundant in Colorado. He noticed the flies ovipositing and observed the eggs under the skin, also stating that the affected currants ripened prematurely and dropped to the ground where the maggots remained in them for some time. He recorded one brood.

Dr. F. L. Harvey in 1895 gives us the most detailed account of the Currant Fly and its habits, with numerous figures. He records it as abundant in Maine, Washington and British Colum-

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[2] Piper and Doane, Insects Injurious to Currants and Gooseberries. Bull. 36. Wash. Ag. Exp. Sta. 1898.

bia, and states that *Epochra canadensis* Loew is quite certainly a native American species, distributed throughout the northern part of the United States and in Canada, extending from the Atlantic to the Pacific slope.

The following notes were taken from observations of the Yellow Currant Fly made in the vicinity of Stanford University. The data here recorded refer to the fly only in the San Francisco Bay region, its habits elsewhere being unknown to the writer from personal observation.

LIFE HISTORY AND HABITS.

The Egg; Its Deposition.

The egg (Plate 11, fig. 2) of the Currant Fly is oblong, shining opalescent white, with a short pedicle at one end. This pedicellate end is finely sculptured in a hexagonal pattern for about one third the length of the egg, giving it a pitted appearance, as shown in the photograph. The egg, measuring slightly over one millimeter, is plainly visible, as a rule, lying directly under the epidermis of the stung fruit with the pedicellate end near the puncture (Plate 11, fig. 3). The adult flies were first observed in Palo Alto on April thirteenth; they probably issued several days earlier. Specimens were sent to the laboratory from San José which had issued on April eighth. The habits of the adult female are very interesting, a constant fluttering of the wings and continual running around in circles on the berries being quite characteristic. As a rule in egg-laying, the fly may prefer a berry that has not been stung before, but among the fruit under observation most of the berries had been stung twice and usually oftener. One case was noted where three eggs lay within a quarter of an inch of each other. When ready to oviposit, the insect comes to rest on the fruit with legs well braced, turns the last three segments with the ovipositor under the body at an angle of about forty-five degrees and makes a puncture in the epidermis (Plate 10).

The time consumed in depositing an egg varies greatly, the maximum period noted being fifteen minutes and the minimum a minute and a half; the usual time consumed is about three minutes. After puncturing the epidermis a long cavity is formed directly underneath the skin, the ovipositor being worked back and forth with a pumping movement accompanied by a constant and rapid movement of the mouth-parts. The result of an attack upon a berry is at first visible only upon close examination, but in a few days the area about the egg turns brown and makes a very conspicuous spot with dark edges as may be seen in Plate II, fig. 3. These spots are also visible in Plate 10.

In the vicinity of Stanford University egg laying continued throughout the mouth of April and till about the middle of May. By that time scarcely a currant or gooseberry could be found that had not been badly affected.

The Larva and Its Development.

After a period of incubation lasting, in the case of specimens taken into the laboratory, for eleven days, the minute white larva or maggot hatches and begins to burrow in the pulp, often following a winding path for some little distance before making its way into a seed. These twisting burrows may often be observed from the exterior. The larva is white, its footless body consisting of about thirteen segments. Protruding from the mouth are two conspicuous black chitinous hooks, the rasping organs, by means of which it gnaws its way through the fruit. This maggot when mature measures about seven millimeters in length. As it continues feasting upon the juicy fruit, its quarters within the seed become cramped, and it then leaves the seed to feed upon the surrounding tissue. The presence of the larva causes the berries to ripen and drop prematurely; they turn red, with unsightly black blotches caused by the decaying matter within the fruit. As soon as the fruit drops, the larvae, if full grown, issue and make their way into the ground. Often, however, they have not attained their full size, in which case they remain within the fallen fruit until mature. According to some observers the larvae may leave the berries before the latter drop to the ground; this however, was not observed by me.

Although nearly all of the currants had several eggs deposited in them, in no instance was more than one mature larva found in a berry; in one case one half-grown and one small maggot were discovered in the same fruit.

The Pupa.

After the larva has penetrated the ground to the depth of an inch or two, or perhaps more, it changes to the pupal condition. The pupa is straw colored and rather hard, measuring about five millimeters. Throughout this stage the insect is, of course, inactive and remains in the ground until the following spring. This fact has suggested some of the methods of control that have been recommended.

The Adult.

There appears to be but one brood, the insects remaining in the ground as inactive pupae for ten months. The writer has not had opportunity to observe this personally, but it seems unlikely that a second brood would have escaped notice for so many years. It is reported that growers state that they obtain a second crop of currants after the insects have disappeared. The only evidence that suggests a second brood, is the report of a single specimen of *Epochra canadensis* collected at Redwood City late in the summer.

As stated above the adults appear about the second week in April and remain near the currant and gooseberry bushes for about a month. The males appear in less numbers than the females, but this may be due to the fact that the former do not confine themselves so closely to the bushes. Numbers of males were found upon the limbs of a nearby apricot tree. They show the same restless habits as the females, running about over the bush with wings a-flutter and often with the mouthparts and transparent sides of the abdomen distended. On the bushes they seem to show no preference for the fruit, as do the females, but are often found upon the stems.

Where the adults pass the night was not discovered. A careful search of the currant and gooseberry bushes and of neighboring shrubs and trees in the morning failed to locate the insects. Often they do not appear in the morning till ten o'clock, especially if the weather is cloudy. The adult insect is rather variable in size, the average specimen being about as large as the common housefly. It may be recognized about currant and gooseberry bushes during the last half of April and first part of May by its pale yellow or orange color, green iridescent eyes and wings marked by dark smoky bands (Plate 11, fig. 4). Probably its most notable characteristic, and the one by which it may be most easily recognized while alive, is the nervous habits previously described. For a complete technical description of the insect the reader should turn to Doctor Harvey's report ('95) on the fly in Maine.

REMEDIAL MEASURES.

The methods usually recommended are as follows:

1. Frequent burning of fallen currants. If some of the maggots leave the fruit before it falls, this remedy cannot be relied on to destroy *all* the flies. However, in fighting a pest it is often the application of a series of control measures which becomes effective.

2. The removal of the top soil underneath the bushes to a depth of two or three inches and placing the same in a traveled roadway or burying it deep would destroy the pupae in the ground. This, of course, should be done only after the crop has entirely gone.

3. A mulch of coarse straw or hay under the bushes, well packed, might hinder the flies from emerging. The efficiency of this remedy is doubtful.

4. Allowing young chickens to run under the bushes at the time of ripening of the fruit should lessen the numbers of the pests.

5. A measure which seems to have met with approval is to pick and destroy the entire crop while green. If there is no fruit in which the flies may lay their eggs they must go elsewhere or perish. This remedy is usually classed as "radical" or "heroical," but the fruit in this vicinity could not be used in any event and might just as well have been destroyed before the larvae had an opportunity to enter the ground. Of course, where the infestation is light, this might not be advisable if part of the crop could be harvested. For most people, however, a few wormy berries in a basket, provided they knew it, would be sufficient to render them unfit for use, unless they did as one discouraged and disgusted lady suggested, "Pickle them and save meat bills"—her fruit was fairly alive with maggots. The trouble with this, as well as with the other remedies, is the fact that if your neighbor has bushes and does not take the same precautions, he will supply you, the following spring, with a bountiful supply of the insects. If, however, no fruit is grown in the vicinity this method should prove effective.

6. A remedy tried by the writer which proved effective, yielding sound fruit in a heavily infested region, was to cover the entire bush with mosquito netting, thus keeping the flies away from the berries. This should be done immediately after the fruit has set; the fly does not attack very young currants or gooseberries. Plate II, fig. 1 shows stages at which both fruits become infested; the small currants at the end of the cluster have not been stung and should be covered at this stage; the same is true of the smaller gooseberries.

This remedy was tried only on a small scale in gardens where the fruit is grown for table purposes. It is not known whether the method could be applied commercially. One large currant bush required three and one half yards of double width netting costing ten cents a yard. The netting should be tied closely about the base of the bush to exclude the flies. The bush itself may be tied together before applying the net, to make it smaller.

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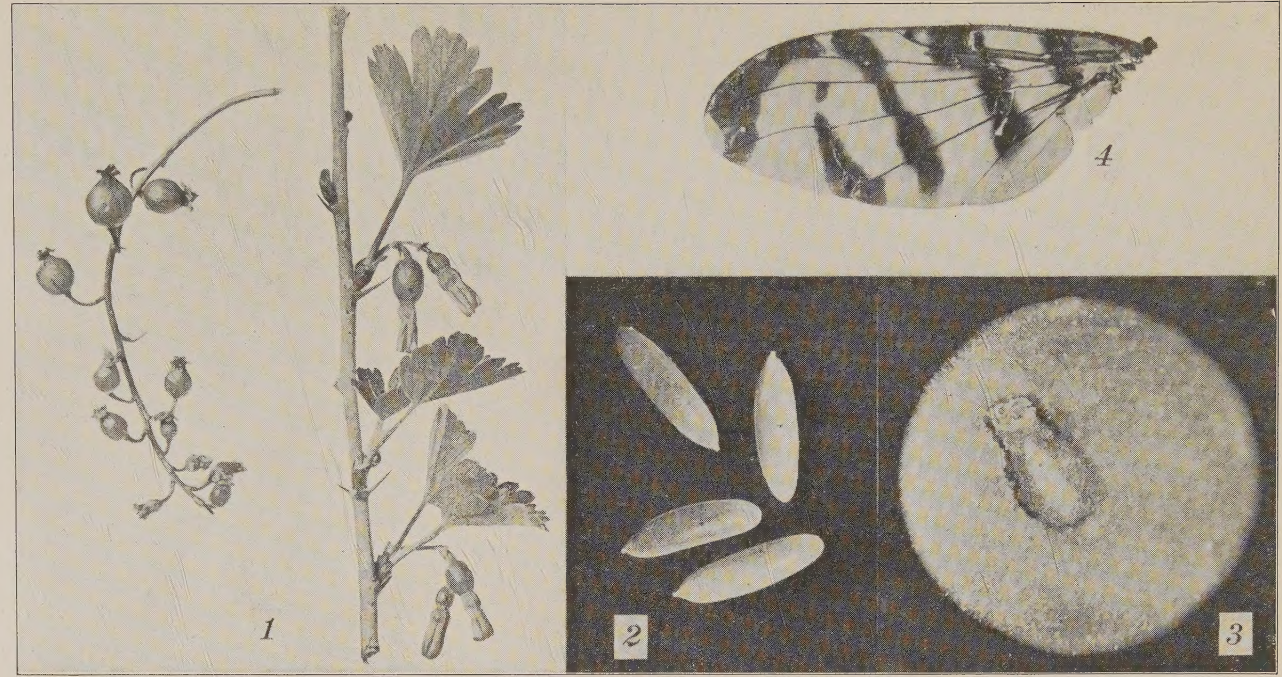

Epochra canadensis Loew. 1, Currants and Gooseberries showing stages at which they become infected; 2, eggs; 3, eggs beneath epidermis of currant; 4, wing.

J. H. Paine, Photo.

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THE STANFORD EXPEDITION TO BRAZIL, 1911.

J. C. Branner, *Director.*

A PROTECTIVE ADAPTATION IN A BRAZILIAN MEMBRACID.

By Wm. M. Mann,
Bussey Institution, Harvard University.

On his first visit to the tropics a collector is sure to have a great many disappointments, especially if he has preconceived ideas as to what he expects to find there. My first surprise came at Para, almost as soon as we landed, when in company with Dr. Heath, I spent the evening collecting at arc lights. Our pockets were full of collecting jars, but we returned, having seen one cockroach and nothing more. Of course, later on we had fair collecting at lights, but in general, conditions were quite unlike our imaginations had pictured them to be. There were noticeable exceptions to the rule, in particular two insect groups ants and the Hemipterous family Membracidæ, which not only came up to our expectations but surpassed them, the former on account of their great abundance and the latter because of the varied and bizarre structures which were quite in accord with our ideas as to what tropical insect life should be.

In the Membracidæ there seems to be no limit in structure beyond which the pronotum will not develop. It may resemble in miniature a Roman helmet, an anchor or a pawnbroker's sign, often being so large and awkward looking that one would think it an actual hindrance to the insect. This awkward appearance impresses one most when the insects are removed from their natural surroundings. On their food plant they are not more noticeable than insects of simpler structure, while some are even good mimics of galls, seeds, fruit and other objects of a vegetable nature. Poulton[1] in an interesting and detailed paper has pointed out the resemblances of many of the Membracidæ to various plant growths and to protected insects such as ants, Coccinellid beetles, etc. He considers the structure and patterns to be distinctly protective in nature. Sharp (Cambridge Nat. Hist. p. 577) states that no remarkable habits are known to occur in the family.

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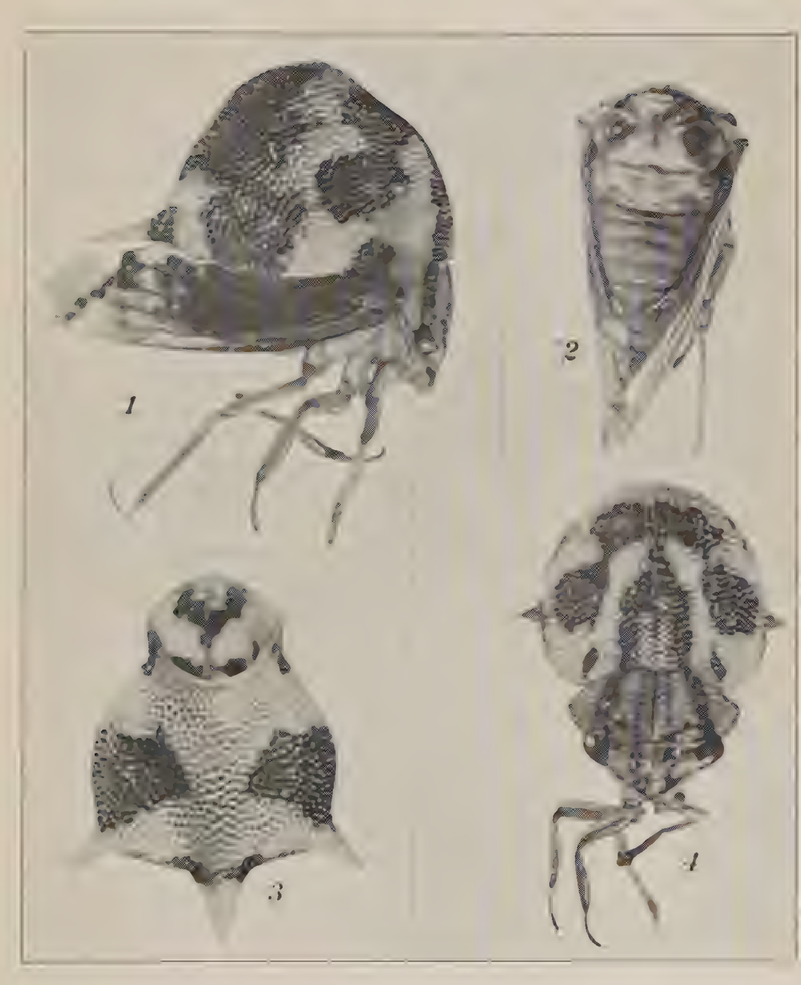
[1] Suggestions as to the Meaning of the Shapes and Colors of the Membracidæ in the Struggle for Existence, in Buckton's Monograph of the Membracidæ. London, 1903.

One of the extraordinarily developed genera of the family is Combophora, which has the pronotum enormously inflated, it being often as large as the rest of the insect, and armed with sharp spines. At Porto Velho, on the Rio Madeira, I had an opportunity to observe living specimens of one of the species (*C. beski* Germ.). Beske, who first observed it, says that the nymphs are attended by ants, which obtain a liquid secreted from a space between the head and pronotum. Poulton suggests that the insect may be a mimic of a Coccinellid beetle. Those individuals which I first found were on a low bush in a little clearing. Ants were running about on the leaves and I was collecting these when the bugs began flying with a loud buzz away from the bush. Those which had remained were on the stems, and their gall-like form and color pattern blended well with the background, rendering the insect quite inconspicuous for such a large, oddly shaped and marked form. I took two before they all flew away, and then found that those I had picked up had flown also, *after detaching themselves from the large inflated pronotum and leaving this for me to place in the collecting bottle!* The species was not at all common locally, and I afterwards found only two specimens. Both of these were flying. When netted they immediately separated from the pronotum, which by itself is far more conspicuous than the rest of the insect, and attempted to fly away without it.

I think it may safely be considered that the easily detached pronotum is distinctly advantageous to the possessor, its use being comparable with that of the loosely jointed tails of certain lizards. Neither of these adaptations is resorted to till coloration or other means of defense have failed, and the object in both cases is to distract the attention of the foe till a place of safety can be reached. The lizard has the advantage of being able to grow another tail, but it is not probable that this means of defense is used many times during the life of an individual. In other ways, the adaptation of Combophora would seem to be an effective defense. The tail of a lizard must give some satisfaction to the captor, and in no wise would deter it from further attacks, but



Combophora beski Germ. 1, Lateral view of complete insect; 2, dorsal view, pronotal development detached; 3, detached pronotum, from beneath; 4, front view of complete insect. Six times natural size.

the hollow, spiny, chitinous object that an insect or bird foe would seize when attacking the tree-hopper could be no possible incentive toward further efforts. In the above cited instance, this adaptation certainly saved two individuals from me, and without doubt in nature is often used successfully, and may be considered as a sort of adaptive self mutilation, or autotomy.

The accompanying plate will give an idea of the appearance of the insect, with and without the pronotal development.

THE STANFORD EXPEDITION TO BRAZIL, 1911.

J. C. Branner, *Chief.*

THE SPECIES OF THE COLEOPTEROUS FAMILY TEMNOCHILIDÆ COLLECTED ON THE EXPEDITION.

By Chas. Schaeffer,
Museum of the Brooklyn Institute, Brooklyn, N. Y.

Temnochila chalcea Kirsch

Berl. Ent. Zeitsch. XVII, p. 149. Reit., Verh. Nat. Ver. Brunn, XIII, p. 13.
Sharp, Biol. Cent. Am. Col. II, pt. 1, p. 397.

Eleven specimens collected at Abuná and Porto Velho, Rio Madeira.

The females of this species, which is widely distributed in Central and South America, have the last ventral segment more or less deeply and broadly triangularly impressed, a rather unusual female character in this genus.

Tenebroides bipustulata Fab.

Fabr. Syst. El. I, p. 152.
Reit. Verh. Nat. Ver. Brunn, XIII, p. 67.
Sharp, Biol. Cent. Am. Col. II, pt. 1, p. 422.

Seven specimens collected at Porto Velho and Abuná, Rio Maderia.

The middle and hind tibiæ are armed with one or two small spines on the upper edge, which is rather unusual in this genus and apparently overlooked by every author dealing with this species.

Tenebroides bipustulata var. **impressifrons** Reit.

Reit. Verh. Nat. Ver. Brunn, XIII, p. 66.
Lev. Bull. Soc. Ent. Fr. 1889, p. VII.
Sharp, Biol. Cent. Am. Col. II, pt. 1, p. 422. One specimen, Rio Madeira.

Differs from *bipustulata* only in the absence of the red elytral spots.

Tenebroides subcostata sp. nov.

Elongate, feebly convex, color of upper surface brown, under side, antennæ and legs castaneous. Head moderately coarsely, not densely punctuate, a narrow space near clypeus almost smooth, with at most only a few very fine punctures. Antennal club abrupt and relatively large, sensitive space of joints large, occupying about half the width of the joint. Prothorax transverse, lateral margin crenulate, scarcely rounded at sides and feebly obliquely narrowing to base at about basal third; hind angles obtuse; anterior margin rather deeply emarginate, anterior angles prominent; basal marginal line almost entire, only narrowly interrupted at middle, surface rather coarsely and densely punctate at sides, less densely at middle. Scutellum small, smooth, shining. Elytra almost parallel, striæ replaced by very narrow, smooth and more or less distinctly elevated lines; intervals wide and very densely irregularly punctate. Underside of head smooth, shining with a few sparse punctures. Prothorax below densely and rather coarsely punctate. Abdominal segments irregularly transversely impressed and rather coarsely punctate. Length 7 mm.

Madeira-Mamoré R. R. Co. Camp 39. One specimen.

Judging from the descriptions this species seems to be related to *anceps* Lev. and *lineolata* Reit. Both have also the elytral striæ replaced by narrow elevated lines but have the intervals distinctly uni- or biseriately punctured, while the intervals in *subcostata* are very densely, confusedly punctate.

Tenebroides vittata sp. nov.

Form short, feebly convex. Color above subæneous, shining, anterior margin of head, lateral margin of prothorax, an almost entire vitta on each elytron, occupying the fifth and sixth intervals and lateral margin narrowly red. Underside, antennæ and legs reddish. Head rather sparsely and finely punctate. Prothorax about twice as wide as long; sides arcuate but feebly narrowing towards base and not sinuate before basal angles; base scarcely narrower than the thorax at apical angles; basal margin almost straight with the angles rectangular, basal line entire; apical margin moderately deeply emarginate, angles acute, surface rather sparsely and finely punctate, punctures a little coarser towards the lateral margin. Elytra slightly wider than the prothorax at base; humeral angles prominent but rounded; lateral margin slightly sinuate below humeral angles; the punctures representing the striæ feebly impressed on the disk but stronger at sides; intervals with a few, scarcely visible punctures. Antennæ rather short, the club nearly as long as the preceding joints. Submentum and gula almost smooth, with only a few coarse punctures at sides. Prosternum very sparsely punctate. Abdominal segments finely alutaceous, not densely punctate. Length 5 mm.

Madeira-Mamoré R. R. Co. Camp 43. One specimen.

I was unable to find a description that would fit this distinct little species.

THE STANFORD EXPEDITION TO BRAZIL, 1911.

J. C. Branner, *Director.*

STUDIES AMONGST THE COCCINELLIDÆ. NO. 3.

By F. W. Nunenmacher,
Piedmont, California.

The following paper consists of a list of the Coccinellidæ taken by the Stanford Expedition to Brazil in 1911. The Coccinellid material of their collection was entrusted to the writer and among the species taken I find two new to science which are described in their proper places in the list.

Genus **Epilachna** Chevr.

Epilachna gossypiata Muls. Rio Madeira, Brazil, 2 specimens.

Genus **Psyllobora** Muls.

Psyllobora confluens Fab. Ceará, Brazil, 8 specimens.

Genus **Cycloneda** Cr.

Cycloneda sanguinea L. Abuná, Bolivia, 1 specimen.

Genus **Exocomus** Redt.

Exocomus bimaculosus Muls. Independencia, Parahyba, Brazil (Mann and Heath).

Genus **Brachyacantha** Chevr.

Brachyacantha manni sp. nov.

Color: head, thorax, legs and meso-episternum of ♂ straw yellow; the posterior portion of the pronotum being piceous with two somewhat rounded prolongations of the same color running forward towards the disk.

♀ with head black, a large straw yellow spot on the occiput; pronotum black with anterior angles straw yellow. Elytra shining black with five straw yellow spots on each elytron arranged as follows: a triangular humeral, a large juxta-scutellar almost touching the humeral, a large squarish marginal near the middle, an oval spot somewhat behind the middle and placed about half its width from the suture, and a transverse oblong sub-apical spot rather closer to the margin than to the suture. Ventral surface piceous except meso-episternum which is straw yellow.

Form rounded oval, convex. *Head* thickly and finely punctured; *Pronotum* a little more coarsely punctured than the head; *Elytra* not so thickly punctured as the pronotum, the punctures being as a rule about the same size but becoming rather coarser at the sides. *Ventral surface;* meso- and meta-sternum very coarsely punctured, the abdominal segments being much more finely punctured. *Length* 2 mm. *Width* 1.5 mm.

Type ♂ ♀ in my collection, cotype in the Stanford University Collection.

Type locality. Independencia, Parahyba, Brazil, 1911, 4 specimens (Mann and Heath).

The ♂ has the fifth ventral segment deeply excavated almost to the fourth ventral suture, this character bringing the species into Leng's fourth group near *B. albifrons* Say. The tibial spurs are very small and sharply pointed. This species comes close to *B. propria* Kirsch as regards the position of its spots, but can readily be separated by its yellow coloring. I take great pleasure in naming this pretty species for its discoverer, Mr. Wm. M. Mann.

Genus **Pentilia** Muls.

? *Pentilia* sp. Independencia, Parahyba, Brazil, 1 specimen in poor condition.

Genus **Scymnus** Kug.

Scymnus sp. Independencia, Parahyba, Brazil, 2 specimens.

Genus **Ayza** Muls.

Azya sp. near *A. scutata* Muls. Independencia, Parahyba, Brazil, 1 specimen.

Genus **Exoplectra** Chevr.

Exoplectra tibialis Muls., Rio Madeira, Brazil, 1 specimen.

Exoplectra brasiliensis sp. nov.

Color: ♀ blood red tinged with yellow, reflexed edges of pronotum and elytra somewhat darker, clothed throughout with a short, fine, whitish pubescence, ventral surface and legs yellowish red. Form broadly oval, convex. *Head* thickly and finely punctured. *Pronotum* rather coarsely punctured, the punctures being distinctly larger than those of the head. *Elytra* slightly more coarsely punctured than the pronotum, the punctures becoming a little deeper towards the sides. *Ventral surface* sparsely and finely punctured, the femora thickly and coarsely punctured, tibial spurs short and blunt. *Length* 3.1 mm. *Width* 2.5 mm.

Type in my collection.

Type locality. Rio Madeira, Brazil, 1 specimen.

At first glance this species was taken for *Corystis hypocreta* Muls. with which the facies and color have much in common. The species however, comes close to *E. ruberimmea* Weise, from which it can be easily separated by its distinctive punctation. This species is among the most interesting of Mr. Mann's captures.

NEW AND INTERESTING DIPTERA.

By Charles W. Johnson,
Boston Society of Natural History.

Leptomydas desideratus sp. nov.

♂. Face and front black, orbits widely margined with brownish pollinose, hairs black; antennæ black, the terminal joint flattened. Thorax black with four grayish pollinose stripes, the two on each side narrowly connected at the transverse suture; the wide black dorsal stripe is divided by a somewhat denuded area, and divided by the suture are also two small similarly denuded subdorsal areas; pleuræ black, shining. Abdomen: first segment black, margined posteriorly with red with a dorsal patch of black, sides of the segment with long black hairs; second, red with an oblong black spot on each side at the lateral margin; third, red; fourth, fifth and base of the sixth, dark brown; the greater portion of the sixth and all of the seventh black; venter with the narrow posterior margin of the first and all of the second, third and fourth segments red, the others black. Legs black, basal half of the posterior femora red. Halteres black. Wings brownish hyaline, veins very narrowly clouded with a darker brown, the second submarginal cell is contracted anteriorly, a slight variation however in this respect is present in the two wings, see figures 1 and 2. Length, 14 mm.

One specimen, Atlanta, Ga., July 9, 1910. Received from Dr. J. Chester Bradley.

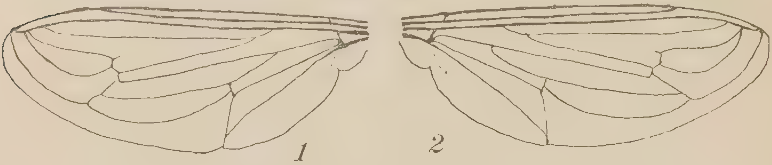


Fig. 1. *Leptomydas desideratus* sp. nov., left and right wings.

This is a very interesting species and possibly throws some light on Walker's Florida and Massachusetts records, for *Mydas isopterus* Wied. = *Dolichogaster brevicornis* Wied.

It seems strange that after so many years and with the amount of collecting that has been done, that something bearing on this record should not have been found.

Minus antennæ the species described could on venation and color be readily confounded with *D. brevicornis.* The venation of *Dolichogaster* as figured by Williston (Manual page 190) does not agree with the type of the genus *D. brevicornis* as figured by Wiedman (Mon. Gen. Midarum, pl. 53, fig. 9).

Ceraturgus similis sp. nov.

Ceraturgus nigripes, Johns., PSYCHE, XVII, 228, 1891 (*non* Williston).

♂. Face with dense yellow pollinose, mystax and beard light yellow; front black, shining with a narrow occipital margin of yellowish pollinose; occiput black, grayish pollinose, hairs black; beak black, tip red; antennæ black similar to *C. cruciatus* but much shorter, the last joint velvety black, due to the presence of very short dense pubescence. Thorax partly covered with a yellowish pollinose, (becoming grayish behind the suture) and arranged so as to form a wide dorsal stripe and on each side two roundish spots of black, narrowly separated by a sutural line; pleuræ and coxæ yellowish pollinose; scutellum black with a grayish pollinose margin; metanotum shining black, sides yellowish pollinose. Abdomen black with wide yellow pollinose posterior cross-bands on all the segments, the first three not quite reaching the posterior margin in the middle; hypopygium shining black, obscured by long yellowish hairs. Femora black, tibiæ and tarsi yellow, tips of the tibiæ and tips of all the tarsal joints black. Halteres yellow. Wings grayish hyaline, with a more brownish tinge the costa and extending over the outer half. Length, 12 mm.

The female is like the male in general appearance. The terminal segments are shining black with a circle of reddish spines at the end of the ovipositor. Length, 13 mm.

The male (holotype) was taken about two miles above Bashbish Falls, Mass., June 27, 1912, and the female (allotype) on Mt. Equinox, near Manchester, Vt., June 5, 1910. Types are in the New England collection of the Boston Society of Natural History.

I referred a single specimen of this species provisionally to *C. nigripes* Will., but an examination of a specimen of that species in the U. S. National Museum proves them to be distinct. It is readily distinguished from *C. nigripes* by its yellow tibiæ and tarsi, and brownish not "pure hyaline" wings.

Nicocles politus Say.

This species was taken by Mr. A. P. Morse at Haggetts Pond, Essex Co., Mass., Sept. 21, 1911. The only other record for this species in New England, is in the Harris collection, Cambridge (Mt. Auburn), Mass., Aug. 1, 1836.

Promachus fitchii O. S.

This species has been captured at Dudley, Mass., July 10, 1911, and Southbridge, Mass., July 7 and 8, 1912, by Stanley W. Bromley. The previous New England records are Amherst, and Mt. Tom, Mass., July 14.

VARIATIONS OF *ORSODACHNA ATRA*—COLEOPTERA.

By C. A. Frost,
Framingham, Mass.

An interesting series of this beetle was taken on the flowers of a clump of Viburnum bushes growing beside a road in the town of Paris, Maine, on June 15, 1910. There were no other clusters of the bushes to be seen in the vicinity, and the surrounding country was largely cultivated, with a few bushes along the road. The elevation is in the neighborhood of 800 feet above the sea level. The following descriptions of the color variations may be worth presenting:

Two specimens.—Piceous black except the base of femora, basal half of tibiæ, base of tarsal joints, and the antennæ beneath, which are testaceous; first antennal joint, and the fourth to tenth inclusive, dark above, except at the bases. Length 6 mm. These are *tibialis* Kirby.

Two specimens.—Head, body, and elytra black. Thorax reddish. Legs mostly reddish-testaceous in one, and mainly black in the other. Antennæ partly dark above as in previous specimens. Length 6 and 4 mm. *Hepatica* Say.

One specimen.—All black except for humeral spots, posterior half of epipleuræ, gular region, mouth parts, antennæ, and the greater portion of the legs, which are testaceous. Length 4.5 mm.

One specimen.—Similar to the last with the addition of a testaceous apical spot on each elytron, and with the femora darker at tip. Length 5 mm.

One specimen.—Similar to the last two but with a smaller apical spot and with the antennæ lighter above; front and middle legs lighter. Length 3.5 mm.

One specimen.—Similar to the last but with the humeral spot extending behind the middle, legs entirely light, antennæ lighter, light area of epipleuræ extending farther forward. Length 4.5 mm. The last three specimens appear to answer to the variety *childreni* Kirby.

One specimen.—Similar to the last but with half of the front and all of the under side of the head testaceous, front angles of the prothorax with a testaceous area extending back along the sides, anterior portion of the prothorax beneath reddish testaceous, part of hind femora piceous. Length 5.2 mm. Between *luctuosa* Lac. and *childreni* Kirby.

One specimen.—All testaceous except occipital spot, body beneath, and a broad post-median band, equaling one-third of the elytra, which extends along the suture and margins to the base, sends out a short submarginal spur posteriorly and darkens the suture nearly to the apex of the elytra; there are also two darker spots and an anterior transverse line on the disk of the prothorax. Length 5.6 mm.

One specimen.—Similar to the last but having the post-median band interrupted near the suture. The metasternal side pieces and the posterior coxæ are here lighter than the abdomen. This approaches *trivittata* Lac. in color. Length 6 mm.

One specimen.—All testaceous but the metasternum, abdomen, a triangular spot near the middle of the elytra extending part way to the humeral angles, the apex of elytra, and a portion of the suture, which are black. Length 6 mm.

One specimen.—Similar to the last with the dark areas still further reduced and the abdomen showing a testaceous shade. Prothorax more reddish yellow. This specimen, at first glance, appears to be entirely testaceous. Length 7 mm.

One specimen.—This has a general fuscous shade with a discal stripe on the elytra lighter. Prothorax reddish. Length 5 mm. *Vittata* Say (?).

In all the above specimens the punctation is about the same; irregularly, coarsely punctate on the prothorax, where the punctures are separated by one to four times their own diameter, becoming closer at the sides; they are closer and more regular on the elytra.

A series taken by me at Fraser, Colorado, July 4, 1911, at an elevation of about 8,000 feet, have the punctation exactly like those from Maine. This series has three specimens of the variety *childreni*, one near *tibialis*, and the rest near *trivittata*. A number of specimens near the last variety were taken on the top of Lookout Mountain near Golden, Colorado, about 7,000 feet. The variations in length are from 4 to 7 mm.

Another series of five specimens, received from Dr. A. Fenyes, taken at Ahwahnee, California, in May, have the elytra so closely punctured, especially on the disk, that the punctures are nearly confluent transversely, causing the elytra to appear rugose. All but one of these specimens have the prothorax reddish, the exception having a discal black spot. Three of them have the base of the femora and part of the tibiæ and tarsi reddish yellow. In color these appear to be near *hepatica* Say. They vary in length from 5 to 7.5 mm.

Through the kindness of my friend, Mr. William M. Mann, I have been able to examine a series of five specimens from "Corte Madera Creek, Cal., III–16-1900," and another of ten specimens from "Pullman, Wash., IV–21–09."

The California specimens have the normal punctation, like those from Maine, while those from Pullman present almost the two extremes of elytral punctation and clearly demonstrate that no line can be drawn by the sculpture. In both series specimens vary from almost entirely testaceous, (having an occipital spot and the suture darker, and the abdomen and metasternum black) to entirely black, with the antennæ, mouth parts, and tarsi piceous. The California specimens all measure 5 mm. in length while the Pullman specimens vary from 4 to 7 mm.

In all the series examined the darker specimens have a closer and deeper punctation but the series from Ahwahnee present such an extreme that, if it were not for intermediates like those from Pullman, they would appear to merit specific rank.

THE HOUSE FLY IN ITS RELATION TO CITY GARBAGE.[1]

By John Howard Paine.

In connection with an endeavor to introduce into the city of Boston the use of paper bags in garbage pails, with the idea of preventing fly maggots from remaining attached to the sides of the pails after collection of the contents, the question arose, "Does the housefly breed extensively in garbage?" To obtain data upon this subject, experiments were undertaken to breed out flies from miscellaneous collections of maggots occurring in city garbage.

Considerable attention has been given to the breeding places of the house fly. A general idea seems to prevail that this species seldom develops in garbage. Howard[2] quotes Professor J. S. Hine, of Ohio State University, as being of the opinion that "while house flies visit garbage in numbers, they appear in most cases to be after food only, as only a few specimens of this species were reared from such material during the season when he was at work." Howard then goes on to say that Professor Hine found that the fly which commonly bred in fermenting vegetable refuse from the kitchen was not the typhoid fly, but *Muscina stabulans*, the so-called stable fly. To quote further, "*Musca domestica* was also reared, as was also another species known as *Phormia regina*, but it seems from these observations, although they were limited to a single locality in Central Ohio, that the recently acquired opinion to the effect that the typhoid fly breeds abundantly in vegetable refuse when it has reached the proper fermenting stage is due many times to the mistake of considering the stable fly and its larvæ as those of *M. domestica*." As will be seen by reference to the table given below, but a single occurrence of *Muscina stabulans* was recorded in the present experiments.

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[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 58.

[2] Howard, L. O. The House Fly—Disease Carrier. F. A. Stokes Co., New York (1911) p. 9.

Newstead carefully investigated the breeding places of these flies in the city of Liverpool and his results, as given by Howard, tend to confirm those of the present writer. He found that the housefly bred in ash pits containing vegetable refuse in the proper state of fermentation, often to the same extent as in stable manure.

Professor R. W. Doane[1] states that, "Decaying vegetables or fruit, fermenting kitchen refuse and other materials sometimes also serve as breeding places." Smith[2], in his observations on the breeding of flies in human excrement in India, has discovered many of these insects issuing from this source, as has previously been noted by others.

The conditions in the section visited in the present instance, one of Boston's tenement districts, would appear to one unaccustomed to such sights, quite alarming. Various species of Muscids, including a large percentage of houseflies, we found swarming about the garbage, depositing eggs and feeding upon it and upon other refuse thrown into the alleys. These were the flies that were supplying the nearby restaurants in such numbers.

The larvæ were collected from the contents of various pails as they were emptied into the carrier's wagon. As a rule they were found in quantities and often were so abundant that the interior of the receptacle appeared as a wriggling mass. In the laboratory the maggots were placed in covered boxes containing a little earth in which they could pupate, and were fed upon stale, water-soaked bread. In a few lots kept in milk bottles the mature larvæ crawled up the sides and into the loose muslin cover in order to find a dry place to pupate. No doubt they escape from the garbage receptacles in the same manner. Cracks or openings in the bottom of receptacles afford an easy means of exit, and often when a garbage barrel was moved many maggots were found on the ground underneath. The little garbage "houses" in which the cans are often kept are excellent places for the larvæ, the floor always containing many cracks by means of which they may easily obtain access to the dry ground underneath. In instances where the garbage had not been collected for two or three weeks, an all too common occurrence, many larvæ had pupated in the dryer, fresher material which had recently been thrown in.

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[1] Doane, R. W. Insects and Disease. American Nature Ser., Group IV, Henry Holt & Co. New York (1910) p. 63.

[2] Smith, F. A Further Note on the Ways of Common Flies in India. Jour. Royal Army Medical Corps. (July, 1908).

TABLE OF REARINGS SHOWING NUMBER AND PROPORTION OF EACH SPECIES COLLECTED.

Lot No.	Number of specimens.					Percentage of house flies.	Date of collection.
	Musca domestica.	*Phormia regina.*	*Lucilia sericata.*	*Calliphora erythrocephala.*	*Muscina stabulans.*		
I	80		40			66.6	Sept. 5
II	9		1			90.	"
III	1		7			12.5	"
IV	8	5	60			10.9	"
V	4		16		1	19.	"
VI			3			0.	Sept. 9
VII	26		1			96.3	"
VIII	7					100.	"
IX	1	1	100	27		.78	Aug. 10
X		139	110	2		0.	"
Totals . . .	136	145	338	29	1		
Per cent . .	22.4	22.3	50.5	4.4	.1	22.4	

When one considers the great numbers of Muscids issuing from the garbage every day during the warm summer months, the presence of twenty-two percent of house flies means that this place of breeding ranks among the first to be considered in a campaign against this insect. The writer has not studied the conditions in other cities but would venture the opinion that those which obtain here are in no way peculiar to this locality.

NOTE ON A PINK LOCUSTID.

While at Woods Hole, Mass., in August, Dr. A. S. Pearse gave me a pink male Locustid which he found on some blackberry bushes in the vicinity. At the time I received the insect, it had not passed through its last instar and I was very much interested to see whether or not it would retain its beautiful pink color after passing through this final stage. Professor Morgan was interested in the animal, and according to his advice, I constructed a cage over some blackberry bushes in a field, thinking that conditions which were approximately the same as natural conditions might be the most favorable for development.

The insect passed through its last moult about one week after I had it in my possession and is fully as pink, wings included, as before, with the exception of the eyes which are white and the ventral side of the thorax and abdomen which are considerably lighter than the other regions of the body.

At present we are engaged in attempting to cross this Locustid with normal green ones of the same species in order to find out what the mendelizing characters are.

Mr. Gray, the curator, found a similar pink form early this summer and, according to Professor Morgan, a yellow form was taken several years ago. This led Professor Morgan to make the suggestion that two factors may be involved, the presence of both of which produces the pink form, the absence of one the yellow and the absence of both factors the ordinary normal green form.

R. W. Glaser.

NOTES ON THE MANTID GENUS *GONATISTA* SAUSS.

By A. N. Caudell,

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Besides the doubtfully included *trifasciata* of Haan from Brazil the genus *Gonatista* is represented in our catalogues as containing a single species, *grisea* Fabr., with four names quoted in the synonymy under it. All these synonymic names are based on early diagnoses of a few broad terms, wholly inadequate for accurate determination. It is indeed doubtful if all the names do refer to the same species, as there are no less than four distinct species of the genus before me from North America and examination of the types of these various species now quoted as synonyms of *grisea* is necessary to settle without doubt their identity and to determine whether, or not, they are all one species. The size of Serville's *phryganoides* shows its distinctness from the larger forms and *cubensis* of Saussure is precluded by its size from being the large species described below as new under the name *major*. *Grisea* Fabr. was published without either measurements or locality and with characters almost equally applicable to any of the four species before me. I follow most authors in using this name for the common species found in the Southern United States. *Phryganoides* Serv. I use for a small finely maculate species from the West Indies. For a third species, also from the West Indies, I arbitrarily use the name *reticulata* of Thunberg and refer to the synonymy under it the *bifasciata* of Haan and the *cubensis* of Saussure. The fourth, and largest, species I describe as new. As stated above a future study of the types of the old authors may show the above nomenclature to be faulty but for the present no better arrangement seems possible.

The four species of the genus as here considered may be separated as follows, the characters based wholly on the male sex, females of several species being unknown to me.

1. Larger, length of elytra over 30 mm.; maculation of elytra consisting of small spots and larger splotches, the latter predominating.................... 2
   Smaller, length of elytra not over 30 mm.; maculation of elytra consisting mostly or almost wholly of small spots........................*phryganoides* Serv.
2. Medium in size, the elytra from 32 to 40 mm. in length.................. 3
   Of large size, the elytra 45 mm. or more in length...............*major* sp. nov.
3. Elytra less densely maculate, distinctly less than one half of the total surface infuscated...*grisea* Fabr.
   Elytra more densely maculate, about one half the total surface infuscated. *reticulata* Thunb.

Gonatista grisea Fabr.

This is the form found in the United States and I have material only from within our borders, though it also surely occurs in Mexico and West Indies. It is of medium size and the elytra are sparsely maculate with spots and splotches, the infuscation covering distinctly less than one half of the total area. The measurements are as folows: Length, pronotum, ♂, 9–10 mm., ♀ 9–11 mm.; elytra, ♂, 32–35 mm., ♀ 18–23 mm.

Gonatista reticulata Thunberg.

This species is represented in the collection of the National Museum by two males from Porto Rico. It is closest to *grisea* but the two specimens before me are lighter in color and the infuscation of the elytra is more profuse, covering about one half the total area. It is also a little larger. I place *bifasciata* Haan and *cubensis* Saussure as synonyms of this form. The measurements of the two males studied by me are as follows: Length, pronotum, 11–12 mm.; elytra, 36–40 mm.

Gonatista major sp. nov.

In general color this species is lighter than either of the preceding ones and is decidedly larger than either of them. The infuscation of the elytra is no more profuse than in *grisea* but is gathered in decidedly larger blotches, in this respect more like *reticulata*. The female is unknown to me. The measurements of the males are as follows:

Length, pronotum, 13.5–14.5 mm.; elytra, 45–48 mm.

Two males, type and paratype, from Dr. W. Zulesky, San Domingo, W. I. Type U. S. National Museum, Catalogue No. 15088.

Gonatista phryganoides Serville.

This is the smallest member of the genus and is represented in the collection of the U. S. National Museum by a series of six males from San Francisco Mts., San Domingo, W. I., taken in September, 1905, by August Busck. Besides being much smaller than any other known species of the genus this differs from all others in the maculation of the elytra, which is here composed almost or entirely of small dots, no large elongate splotches being present as in the larger forms. I have seen no females of this species. The measurements of the males studied are as follows:

Length, pronotum, 7.5–9 mm.; elytra, 26–28 mm.